THE town of Bhamo, in Upper Burma, the destruction of which by the Kakhyen tribes is reported from Rangoon, is one well known in the exploration of South-Western China in recent years. The route so often traversed from Shanghai to Rangoon by the Yangtsze, Talifu, and the Irrawaddy passes through Bhamo. It is mainly a trading town, from which the caravans start into Yunnan, as here the navigation of the Irrawaddy ceases. The first modern explorer to visit it was Mr. Cooper, the traveller "in pigtail and petticoats," who journeyed so courageously throughout South-West China during the Mohammedan rebellion. The Indian Government was disposed at that time to pay more attention to a trade route into Yunnan than they appear to have been recently, and the importance of Bhamo on the route from British Burmah was recognised by the appointment of an agent to reside there, and gather information useful for commerce in these regions. Mr. Cooper, the most competent man for the post, was selected, but the good work which he was doing was cut short by his death one night in his tent near Bhamo, at the hands of one of his Burmese guards. At Manwyne, not far on the Chinese side of Bhamo, Mr. Margary was murdered in 1876, when on his way from the Yangtsze and Talifu, to meet Col. Browne's expedition, which advanced from Rangoon along the Irrawaddy, through Bhamo. A year later it was visited by the Commission of English officials under Mr. Grosvenor, which went to inquire into Margary's death; and, on account of the place being within easy reach of Rangoon and Mandalay by the river, it has been frequently visited by officials of the Indian Government, such as Cols. Browne and Fytche and Major Sladen. The latter's journey had for its object the removal of dangers to traders on the route from the Kakhyens, and he succeeded in coming to an understanding with the chiefs to keep the route open. Within the last few years McCarthy, on his way from Shanghai by the Japanese route, and Colquhoun from the capital of Yunnan, passed through the town. It was a small stockaded settlement of Chinese and Shan traders, with a lower order of Burmese, and there is a French missionary station at the place, while some Americans are also engaged in missionary work there and at Mauwyne. The Kakhyens inhabit the greater part of North-Eastern Burmah, between the Irrawaddy and Salween, and live mainly on the trade between China and Burmah, either as brigands and robbers or as carriers on the river and roads. In addition, they appear to trade a little on their own account. The grounds of their destruction of the town are unknown, but it is probably due to their predatory habits, the comparative wealth of the town as a central trading station in the region, and the weakness and incompetence of the native government of Upper Burmah, especially in a wild and remote border-land, such as that in which Bhamo is situated, and of which it is the capital.

AN interesting expedition has been undertaken by Mr. Shaw, a naturalist and artist of Sydney, New South Wales. He proposes to make a canoe voyage down the Lachlan, Murrumbidgee, and Murray rivers, his object being to enlarge our knowledge of the interior river-systems of Australia, and of natural history. The cost of the expedition is borne by the *Town and Country Journal* of Sydney, in which the artist's sketches will no doubt appear.

WE learn from the Australian papers that Mr. E. M. Curr of Victoria has been engaged on a work on the customs, language, and origin of the aborigines of Australia. Portions of the manuscripts were, early last year, sent to England to be submitted to the Council of the Anthropological Society. The Society has expressed the opinion that the Government of Victoria should publish the vocabularies and a record of the customs of the aborigines, as, otherwise, valuable information might be lost for ever. It is expected that arrangements will be made for the publication of the work at the public expense.

REPORT OF THE LONDON SCHOOL BOARD COMMITTEE ON TECHNICAL EDUCATION

WE are glad to publish the following Report on Technical Education which has been presented to the London School Board. The recommendations contained in it were passed on December 18, 1884, with a small modification in No. 5. The only one which received any serious opposition was No. 6, which relates to the Swedish Slöjd system, but this ultimately passed by a majority of two to one.

(1) *Constitution of Committee*

On February 1, 1883, the Board passed the following resolution :—"That a Special Committee be formed to consider and advise how far the Board may facilitate Technical Education, or co-operate with those bodies that are carrying it on."

On February 8, 1883, the Board resolved :—"That the Special Committee on Technical Education agreed to by the Board on February 1, 1883, consist of the following Members :—Mr. Roston Bourke, Mr. Bousfield, Mr. Bruce, Sir Edmund Currie, Miss Davenport Hill, Prof. Gladstone, Mr. Heller, Sir Arthur Hobhouse, Mr. Lucraft, Miss Muller, Rev. Henry Pearson, Mr. Lee Roberts, Mr. Whiteley, Mr. Mark Wilks, and *ex officio* the Chairman and the Vice-Chairman of the Board."

At the first meeting Prof. Gladstone was appointed Chairman of the Special Committee. Nine meetings of the Committee have been held.

(2) *Information from Gentlemen*

The Committee commenced their deliberations by endeavouring to obtain information from gentlemen who were interested in, and had studied, the subject.

The following gentlemen accordingly attended the Committee by invitation, and gave their views on the subject :—Dr. Silvanus P. Thompson, Professor of Natural Philosophy at University College, Bristol; Mr. H. Trueman Wood, Secretary of the Society of Arts; Mr. Philip Magnus, B.Sc., B.A., Director and Secretary of the City and Guilds of London Institute for the Advancement of Technical Education, and one of the members of the Royal Commission on Technical Instruction. The statements of these gentlemen are set out in detail in the Appendix to this Report.

(3) *Information from School Boards*

The Committee also obtained information from the clerks of the Glasgow, Manchester, and Sheffield School Boards respecting the steps taken by these Boards respectively for the instruction of children in technical education.

Glasgow, Allan Glen's Institution.—At the request of the clerk of the Glasgow School Board, Mr. A. Crum Maclae, Secretary of Allan Glen's Institution, Glasgow, replied, furnishing information respecting the technical instruction in that institution, and inclosing—(1) a prospectus of the school for 1883-84; (2) a report of the proceedings at the distribution of prizes and certificates in December, 1882; (3) a copy of a paper on the "Relation of the School to the Workshop," read before the Philosophical Society of Glasgow in December, 1882, by David Sandeman, Chairman of the Weaving Branch of the Technical College, and E. M. Dixon, B.Sc., Head Master of the Institution.

Manchester School Board.—The Clerk of the Board, in reply to the inquiry of the Committee, furnished information to the effect that the Board have no present intention of starting a technical school; that this work had been taken up by the trustees of the Manchester Mechanics' Institute, who have converted that institution into a technical school; that the Board have introduced a lathe and a group of joiners' benches into class-rooms of two of their schools, and each scholar in the higher standards of the school takes his turn at the manual exercises, receiving one or two lessons a-week, a joiner being present to give the instruction. No extra charge is made for the instruction. One of the schools is the lowest under the Board, where two-thirds of the children are admitted free, the other being attended by children of artisans and small shopkeepers.

Sheffield School Board.—The Clerk of the Board gave particulars respecting the admission, the examination, the fees, the subjects of instruction, and the results of the Central Higher School established in that town. In the workshop attached to the school the practical work contemplated will include—(1) the production of simple but perfect geometrical forms to teach accuracy and skill in the use of tools; (2) the construction of models in wood for use as examples in model drawing; (3) the construction of simple apparatus to illustrate, by actual experiment, the principles of levers, pulleys, wheel and axle, the crane and strain on beams with different positions of load; (4) the mechanics of the roof, arch, and bridge; (5) for more advanced pupils the construction of apparatus illustrating lessons in machine construction, applied mechanics, building construction, and mechanical engineering. It is added that there is a system of scholarships by means of which from fifteen to twenty specially clever boys and girls will be enabled to pass from the

ordinary schools to the technical instruction at the Central Higher School.

(4) *Action of British Association and Social Science Congress*

The Committee were officially informed by the chairman that a resolution had been passed in 1883 by the British Association for the Advancement of Science requesting a Special Committee "to consider the desirableness of making representations to the Lords of the Committee of Her Majesty's Privy Council on Education in favour of aid being extended toward the fitting-up of workshops in connection with elementary day schools or evening classes, and of making grants on the results of practical instruction in such workshops under suitable direction." The said Committee waited to see the Report of the Royal Commissioners, and expressed their approval of recommendation (*d*), which practically covers the same ground. The Social Science Congress has made a presentation to the Education Department to a similar effect.

(5) *Recommendations of the Royal Commissioners on Technical Education*

During the deliberations of the Committee the second Report of the Royal Commissioners on Technical Education, containing their recommendations, was published, and the Committee submit, for the information of the Board, the recommendations as to public elementary schools, as follow :—

(*a*) That rudimentary drawing be incorporated with writing as a single elementary subject, and that instruction in elementary drawing be continued throughout the standards. That the Inspectors of the Education Department, Whitehall, be responsible for the instruction in drawing. That drawing from casts and models be required as part of the work, and that modelling be encouraged by grant.

(*b*) that there be only two class subjects, instead of three, in the lower division of elementary schools, and that the object lessons for teaching elementary science shall include the subject of geography.

(*c*) That, after reasonable notice, a school shall not be deemed to be provided with proper "apparatus of elementary instruction" under Article 115 of the Code, unless it have a proper supply of casts and models for drawing.

(*d*) That proficiency in the use of tools for working in wood and iron be paid for as a "specific subject," arrangements being made for the work being done, so far as practicable, out of school hours. That special grants be made to schools in aid of collections of natural objects, casts, drawings, &c., suitable for school museums.

(*e*) That in rural schools instruction in the principles and facts of agriculture, after suitable introductory object lessons, shall be made obligatory in the upper standards.[1]

(*f*) That the provision at present confined to Scotland, which prescribes that children under the age of fourteen shall not be allowed to work as full-timers in factories and workshops, unless they have passed in the Fifth Standard, be extended to England and Wales.

(6) *The Slöjd System of Handicraft in Sweden*

The Committee have received valuable information respecting a system of instruction in handicraft, which is largely adopted in the elementary schools of Sweden. Two mistresses under this Board, Miss Warren, head mistress of the infants' department of the Carlton Road, Kentish Town, School, and Miss Clarke, head mistress of the infants' department of the Campbell Street, Maida Vale, School, were allowed an extended summer vacation, in order that they might visit Herr Abrahamson's Institution at Nääs, near Gothenburg, in Sweden, where instruction is given in handicraft. This institution is established and maintained by Herr Abrahamson on his own estate, for the purpose of training teachers in the system, in order that the teachers may be able to carry it out in their schools.

The Governments of some other countries were invited to send teachers to Nääs to learn the system, and through Miss Löfving, formerly Superintendent of Physical Education under the Board, the invitation was extended to two mistresses of the schools of the Board. Hence the visit of Miss Warren and Miss Clarke during last summer. These mistresses have returned with diplomas received from Herr Salomon, the Director of the "Slöjd" Seminarium at Nääs, for having successfully completed the set of articles required for the first course of the system.

Miss Warren stated that during the two months leave of absence which had been granted to her and Miss Clarke, they had, at the invitation of Herr Abrahamson, visited his institution, with the object of becoming acquainted with his system of instruction in handicraft. The work done is carried out in wood, and the general term of "Slöjd" is applied to it. Working in wood is considered the most useful, as by working in this material the advantages claimed for the system are obtained more easily and completely than by the adoption of any other material. Miss Warren exhibited to the Committee forty articles in wood, selected from the 100 articles, forming the course of instruction, which she had made during her visit. The system of instruction is divided into what is called the "Nääs" system, from the estate on which it is carried out, and the "Artisan" system. The "Nääs" system differs from the "Artisan" in that it is not called a trade, the work, mainly in wood, being carried out under the superintendence of a *teacher*, and not being sold.

The work is done in a room fitted with benches, the room being about the size of one of our smaller halls. Only one teacher is in this room. The tools used all come from England and America. The cost of the tools per child is about 30 kronor, or 32*s*. 6*d*. The cost of the wood for 100 models is, *in Sweden*, about 15 kronor, or 16*s*. A complete set of the tools required could be obtained for about 4*l*. 10*s*.

The object of the system is not so much to produce the articles as to educate and train the child itself. The promoters of the system claim for it five distinct advantages :—

(1) It produces in a child a love of manual labour.
(2) It promotes the development and training of a child's hands and fingers.
(3) The child learns order and exactness.
(4) It educates a child's observation and perceptive faculties.
(5) It teaches self-reliance.

The school hours in Sweden are from 8 a.m. to 1 p.m., with an interval of a quarter of an hour about eleven o'clock. The instruction in "Slöjd" is usually taken in the afternoon. About two and a half hours on three days a week are devoted to this work. "Slöjd" is encouraged and paid for by Government, but is not compulsory. Children begin the work at about ten years of age. It is a punishment for a child to be withheld from it. Everything made is a *useful* article, the making of toys being prohibited. The articles when finished are given to the children as an encouragement. The child who does not succeed in the ordinary subjects of study is frequently encouraged on being successful in "Slöjd."

(7) *The Peripatetic System of Science Teaching in Birmingham*

In the course of their deliberations the Committee have noted and carefully considered the system of science teaching adopted by the Birmingham School Board. This system is sometimes called the "peripatetic" system. The elementary science "is taught in accordance with a syllabus, by a practical demonstrator and assistant (who visit each boys' and girls' department once every fortnight), and by the teacher of the school. The Science Demonstrator for the Board (or an Assistant Demonstrator) gives one lesson fortnightly of about forty minutes' duration to the boys in the Fifth and higher Standards in each school. The lessons are illustrated experimentally by specimens and apparatus carried from school to school in a hand-cart. Between the visits of the Science Demonstrator at least one lesson is given to the same class by the teachers of the respective schools (as a rule by a teacher who was present at the Demonstrator's lesson, and took full notes of it), and a written examination on the subject-matter of the lesson is also held. The answers are corrected by the class teacher and submitted to the Demonstrator at his next visit to the school. A general examination in elementary science is held yearly." The syllabus for boys comprises demonstrations on force, the mechanical powers, machines, parallelogram of forces, &c.; and that for girls demonstrations on the structure of the human body, circulation and respiration, the organs of digestion, the nervous system, the nature of food and its preparation, apparatus for cooking, how to maintain the body in health, the sick room, diseases of children, accidents, &c.

(8) *Conclusions*

After considering in all its bearings the whole question of the introduction of technical education and training into the schools of the Board, the Committee are of opinion that there is at present too little instruction for boys which is calculated to train and exercise the hand and fingers, so as to fit lads more efficiently

[1] This recommendation will not apply to London schools.

for situations where skilled manual labour is required. In this respect boys are worse off than girls. It is only in the drawing lesson that the boys receive any training of the hand, whilst girls obtain it in the needlework and cooking lessons as well. The Committee do not consider it desirable to attempt to teach any special trade or handicraft in the schools of the Board; but they are of opinion that in boys' departments greater attention should be paid to the teaching of "elementary science" and to freehand drawings from models; that mechanical drawing and modelling in clay should be introduced; that the peripatetic plan of teaching mechanics should be tried as an experiment in some district in London; and that, as an experiment, arrangements should be made for the establishment of a class for the elementary instruction of boys in the use of tools as applied to working in wood, the attendance being voluntary and out of school hours.

The Committee desire to express their high appreciation of the services rendered by Mr. Thomas Smith, and the zeal with which he has assisted them in their work.

(9) *Recommendations*

The Committee accordingly submit for adoption the following recommendations, which are intended to apply to boys' departments only:—

(1) That it is not desirable to attempt to teach any special trade or handicraft in the schools of the Board.

(2) That the instruction in drawing commence with Standard I. and be carried out according to a graduated scheme laid down for each standard.

(3) That increased attention be paid to freehand drawing from models in all schools, and that mechanical drawing and modelling in clay be introduced into certain schools.

(4) That greater attention be paid to the teaching of "elementary science" in the schools of the Board.

(5) That the peripatetic plan of teaching "mechanics" be tried in some district or districts of London.

(6) That, as an experiment, arrangements be made for the establishment of a class for the elementary instruction of boys in the use of tools as applied to working in wood, the attendance being voluntary and out of school hours.

(7) That the above resolutions be referred to the School Management Committee, with instructions to carry them into effect.

(8) That the sum of 10*l.* be paid to Mr. Thomas Smith, Principal Clerk of the School Management Department, as remuneration for his extra services in connection with this Committee.

(Signed) J. H. GLADSTONE, *Chairman*
B. LUCRAFT
H. D. PEARSON

APPENDIX

Statements of Dr. Silvanus P. Thompson, Mr. H. Trueman Wood, and Mr. Philip Magnus

I. Statement of Dr. Silvanus Thompson, Professor of Natural Philosophy at University College, Bristol, made before an informal meeting of the Committee on Technical Education, April 17, 1883.

Prof. Thompson stated with regard to drawing, that in his opinion the drawing taught and paid for by results by the Science and Art Department was not of the character which he considered should be taught. The subject he wished to see taught was what he liked to call industrial drawing, by which he meant that a block of wood or metal being placed before the children, they should execute from it drawings showing it in two or three different ways, exactly in the fashion in which workmen's drawings are made. Drawings made to scale represented in the workmen's fashion would be very much more valuable than the drawings executed under the regulations of the Science and Art Department. Industrial drawing such as this may be made applicable to all kinds of work, carpentry, masonry, &c.

He then described a lesson on drawing given in Paris on the general mechanism of tools. The lesson consisted in the master sketching roughly on the blackboard the outlines of certain pieces of machinery. He had neither compasses nor ruler. Every line had a distinct meaning, and every single detail was labelled. The boys were then told to make proper working drawings from this sketch. This kind of training seemed to him a very valuable thing. To know how to "read" a drawing is much more important than to turn out a highly-finished work of art. The main difficulty in introducing such a system would be that it would have to be created. No instructor in technical education had yet made it worth his while to evolve a system.

Prof. Thompson suggested that a section of certain schools might be devoted to the teaching of handicrafts. Some of the ordinary handicrafts in wood or metal would be good subjects to commence with. It would be better to try the experiment in one small school unless the Board are prepared to go to a very great expense.

He considered that a good deal might be done in training the hand and the eye by the introduction of clay modelling. As illustrating the value of modelling in clay, he stated that in Paris the masters' union for the manufacture of jewellery had established a little school for teaching the knowledge and practice of art required in making jewellery. In this school there is modelling in clay and wax, drawing from the cast and from the flat, and also a little actual model work. Various works of art are hung round the room, and from the cast the pupils model in clay. After that there is a course of modelling in wax. The children are about nine or ten years of age. Some begin their attendance here as early as eight.

Cutting stone and carving in wood are good subjects. Plastering is merely pouring plaster into a mould, and mechanics is not of a very technical order. He doubted whether glass-blowing would be useful. The opinion of the union was greatly against the increase in the number of apprentices. Glass-blowing was taught at a disadvantage in England, because the union would not sanction each master having more than one boy.

The subjects that might be taught to girls are wood carving, vellum painting, the making of artificial flowers, and dress-making. Engraving would be expensive. A great deal of chain-making is done by female labour, but there is not much to learn in it.

He knew of no place where these handicrafts were carried on, with the exception of a few orphanages.

II. Statement of Mr. H. Trueman Wood, Secretary of the Society of Arts, made before the Special Committee on Technical Education, June 13, 1883.

Mr. H. Trueman Wood gave the Committee some information about the origin of the City and Guilds Institute for the Advancement of Technical Education, with the foundation of which he had been associated. The work which that Institute was now engaged upon the Committee would have more fully set before them by Mr. Magnus. He gave a brief sketch of the movement which, originating in a proposal to establish a Technical University in London, had resulted in the formation of the City Institute, with its "Central Institution" now in course of erection at South Kensington, and its Technical Schools in Finsbury and Lambeth. He also described the system of Technological Examinations which, originated by the Society of Arts, had been taken over by the Institute, and developed to its present condition by the aid of a scheme of payment on results, similar to that of the Science and Art Department.

Mr. Wood, in reply to various questions put by Members of the Committee, gave the following additional information:—As regards those who attended the school in Finsbury, he could not speak with any knowledge, but he did not think that the larger proportion of them were artisans; he believed they were chiefly clerks and young people of the usual science student class. Some of them, he understood, were boys from the Middle-Class School in Cowper Street. He did not know of any school where boys of the artisan class of twelve or fourteen years of age could go and learn the use of tools, and he was not aware of the existence of any such school in England. He stated that he was strongly of opinion that mechanical drawing should be taught in all elementary schools. The industrial training given in industrial schools was, of course, one form of technical education, but he should scarcely include this in what should be taught in elementary schools. He was of opinion that it was not possible to give definite technical instruction in elementary schools; the children were too young, and, in many cases, it could not be said which trade they would follow in after-life. He did not himself see how more could be done than was being done in Birmingham, where, he understood, practical teaching in elementary science was given to the children. Such teaching as this he believed to be most valuable, and the best possible preparation for the specialised technical instruction which would come later on. Elementary mechanics should certainly be taught and should be illustrated by suitable apparatus. He quite

agreed that general instruction in handicraft would be useful, teaching children the use of tools without reference to special trades, and, he believed, the experiment of fitting up a workshop in one school was one that was worth trying, and would not be, in his opinion, very costly. He left, as an open question, whether such workshop should be used in playtime, or during the ordinary school hours.

III. Statement of Mr. Philip Magnus, B.Sc., B.A., Director and Secretary of the City and Guilds of London Institute for the Advancement of Technical Education, and one of the members of the Royal Commission on Technical Instruction, made before the Special Committee on Technical Education, July 4, 1883.

Mr. Philip Magnus gave the following evidence:—

He stated that there is a double object in the establishment of the Central Institution, now in course of erection at South Kensington. On the one hand, it is intended to give the highest technical education to persons preparing to become engineers, manufacturing chemists, and managers of industrial works, and other persons engaged in scientific research in its application to particular trades. On the other hand, it is especially intended as a training school for technical teachers. The latter function of the institution is considered the more important, because the experience of all persons connected with technical education has shown that there is a great need of duly qualified technical instructors in all parts of the kingdom. It is very likely that arrangements will be made by which teachers will be able to come up to London in the summer months and to obtain lessons in applied science and in the best methods of technical teaching.

As regards the students who attend the Technical College, Finsbury, he wished to say emphatically that a large portion of them are artisans. There are indeed two classes of students who attend the Finsbury Technical College: one class coming in the daytime and the other in the evening. The evening students are almost all engaged in industrial work, and very few of them are clerks. Of those who attend in the daytime, he might say, none are clerks. A few have already been engaged in industry, and, feeling the want of technical instruction, have given up their trade to devote a year or two to study; but the great majority are youths who intend to follow industrial pursuits, and are carrying on their studies with that object. The total number of students in attendance at the College in the evening classes is 621, of whom 132 are apprentices admitted at half the usual fee. Of the day students there are at present about 100 in attendance, the school being opened under its present organisation only in February last. These students come from various middle-class and higher grade schools. A fair proportion of boys are expected to come from the Cowper Street schools, immediately adjoining the college. At the same time it is hoped that pupils will come to the College from other schools of the same grade. It is indispensable that the boys to be admitted should have a good knowledge of arithmetic and of the rudiments of mathematics; *i.e.* they should be able to solve simple equations and understand thoroughly the first book of Euclid.

In answer to the question whether the Finsbury Technical College could be made available to boys from elementary schools, Mr. Magnus said he saw no reason why boys from the higher grade of elementary schools, possessing a knowledge of elementary mathematics, should not be admitted into the College.

In answer to the Chairman, he said it would be well for candidates for admission to have some knowledge of the principles of science, although such knowledge is not absolutely necessary, as some of the Professors of the College stated that they would almost as soon commence the teaching of science as continue the instruction of badly taught students.

The limit of age for the admission of students is fixed at fourteen. Students entering at fourteen, having a fair knowledge of the elements of algebra and geometry, and an acquaintance with some of the principal facts of physical science, would be well able to go through the prescribed courses of the Finsbury College; and such knowledge might be acquired by boys who had passed through the higher Standards, and had taken mathematics and mechanics as specific subjects.

Mr. Magnus thought it would be preferable that boys leaving the Board Schools should be selected about the age of twelve or thirteen, and drafted into higher elementary schools where they might receive the necessary instruction in mathematics and science, and that they should be drafted from these higher elementary schools to the Finsbury Technical College.

The subjects taught at the Finsbury College are practical science, including physics, mechanics, mathematics, and chemistry, mechanical and freehand drawing, handicraft work, French or German, or both. In the workshops the students are taught to work in wood and metal at the bench and at the lathe. They learn not only the use of tools, but to chip, file, turn, and to con truct simple apparatus.

(Mr. Magnus here put in evidence his address at the opening of the Finsbury College, as well as the programme of instruction.)

Apprentices and workmen attend the evening classes to learn the more difficult operations of their trade, and to gain an insight into the processes of which they cannot always obtain satisfactory explanation in the shop. It is to correct the effects of extreme division of labour that evening technical classes are most needed.

As regards carpentry and joinery, the institute is now endeavouring to devise a scheme of evening instruction in connection with the technological examinations, which will probably lead to the establishment of evening classes in this subject in several provincial towns.

Having been asked how the School Board might aid in the development of technical education, Mr. Magnus said that the Board might aid in various ways.

Instruction could be given in the elementary schools in machine drawing. Better instruction might also be given in freehand drawing, of the defects of which the institute's examiners in technology generally complain. In a large number of schools workshops might with advantage be established, in which a certain number of the more advanced boys might have the opportunity of gaining instruction in the use of tools, in the same manner as is done in the primary schools in France under the new Act. It would be a great advantage to the boys on leaving elementary schools, be their occupation what it may, to have acquired the facility of using their hands, and to have gained a knowledge of the properties of different kinds of wood, as well as of iron and other metals, which could only be obtained by working these substances themselves. By the establishment of workshops in schools, the boys, when apprenticed, would advance more quickly in their career, and reality would be given to their scientific instruction as well as to their lessons in mechanical drawing. He considered the great want of this country to be higher elementary or intermediate schools of a technical character. As regards the scheme of education to be given in such schools, he referred to his address on "Technical Instruction in Elementary and Intermediate Schools," delivered before the Society of Arts. He thought that scholars who distinguished themselves at the ordinary elementary schools should be sent to technical schools of this description in preference to such schools as the City of London School or King's College School. Here, in England, education is too distinctly and exclusively literary. We want schools in which practical science, mathematics, and modern languages shall be the chief instruments of education. It has been the object of the City and Guilds of London Institute partly to supply the deficiency by supplementing the existing educational machinery. The Central Institution at South Kensington will, doubtless, exert considerable influence on all schools leading up to it. It will show that there is a school of the same grade as the ancient Universities, giving a practical scientific training instead of a literary or theoretical education. The selected boys from primary schools should be led up to the Technical University or Central Institution rather than to the existing Universities, where they are too often drafted into professional careers which are already overcrowded.

In answer to an inquiry as to the view Mr. Magnus held as regards the value of the study of English literature in schools, Mr. Magnus stated that he attached the highest importance to the study of English literature in higher elementary schools as developing the imagination and giving pupils a taste for reading.

Besides mechanical and freehand drawing, pupils having a taste for art should be taught modelling, the study of which is not sufficiently developed in this country.

He considered that geometry should be taught practically without Euclid; whilst Euclid is very valuable to those who wish to become thorough mathematicians, he thought that very few of those who learn the elements of Euclid derive any practical benefit from the study. Abroad, geometry is generally taught without Euclid.

As regards the technological examinations, Mr. Mangus said that four years ago the institute took over these examinations from the Society of Arts, which had previously conducted them under somewhat different conditions. The candidates have increased very much during these four years, especially those in mechanical trades. At the time of the transfer of the examinations, the number of candidates was 212, whereas this year, 1883, the number of candidates amounted to 2397.

The Council of the Institute are very desirous that scholarships should be established in connection with the Finsbury College and other similar technical Colleges throughout the kingdom, to enable promising pupils to carry on their education at the Central Institution. If children could be taught sufficient mathematics and elementary science to be transferred from the Board schools to the Finsbury College, or to some other technical school, and thence to the Central Institution, he considered the ladder of technical education would be complete.

He thought that the Board might further aid in assisting technical education by the loan of its rooms for the formation of evening classes, it being always understood that, in order that the instruction should be of any use, it must be of a practical character, and that the classes should be well furnished with all necessary models, apparatus, &c.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

MR. THOMAS PURDIE, Ph.D., B.Sc., Associate of the Royal School of Mines, has been appointed Professor of Chemistry in the University of St. Andrews, vacant by the retirement of Dr. Heddle.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, December 4, 1884.—William Carruthers, F.R.S., Vice-President, in the chair.—The following were elected Fellows of the Society:—The Hon. F. S. Dobson, W. A. Haswell, Geo. W. Oldfield, Dr. G. W. Parker, M. C. Potter, T. J. Symonds, W. A. Talbot, and J. H. Tompson.—Mr. W. T. Thiselton Dyer exhibited:—(1) Examples of leaves of *Sagittaria montevidensis* under different modes of cultivation, the changes thus induced as regards size and general facies being most remarkable, so much so that they might be deemed widely separate genera. The small leaves were from a plant raised from seeds collected in Chili by Mr. J. Ball, F.R.S., and sent to Kew in 1883, and grown in a pot half submerged in the *Nymphæa* tank. The enormously large leaf and spike were those of a plant raised from seeds, ripened at Kew, and sown in spring (1884). When strong enough the plant was planted in a bed of muddy soil, kept saturated by means of a pipe running from the bed to the *Nymphæa* tank. (2) A special and peculiar instrument called a "Ladanisterion," from Crete, it being a kind of double rake with leathern thongs instead of teeth, and used in the collecting of gum Labdanum, a drug now dropped out of modern pharmacy. The instrument in question was procured for the Kew Museum by Mr. Sandwith, H.M. Consul in Crete. (3) A collection of marine Algæ from West Australia, brought to this country by Lady Broome.—A paper was read by Dr. Francis Day on the relationship of Indian and African fresh-water fish-fauna. In this communication the author refers to certain papers of his, read before the Society on previous occasions, but he more particularly deals with the differences shown between his own statements therein and those subsequently given by Dr. Günther in his "Introduction to the Study of Fishes." Dr. Day is inclined to believe that in the consideration of Indian fish distribution there seems a possibility that certain marine forms, for example, the Acanthopterygian *Lates*, the Siluroid family Arünæ, and others have been included among the fresh-water fauna by Dr. Günther, whereas fresh-water genera, such as *Ambassis*, several genera of the Gobies, *Sicydium*, *Gobius*, *Eleoteris*, &c., have been omitted from the fresh-water fauna of India by Dr. Günther. Thus Dr. Day attempts to show that there may be less affinity between the African and Indian regions, so far as fresh-water fishes are concerned, than there is between his restricted Indian region and that of the Malay Archipelago. He adds that of 87 genera found in India, Ceylon, and Burmah, 14 extend to Africa, 44 to the Malay Archipelago, whereas out of 369 species only 4 extend to Africa and 29 to the Malay Archipelago.—On the growth of trees and protoplasmic continuity, was a paper by Mr. A. Tylor, giving his experiments in the curvature assumed by branches, particularly those of the horse-chestnut. He pointed out that the terminal bud is constantly directed upward, but is straightened out at a later stage of growth. Further, he found that terminal buds, when directed by being tied against a tree-trunk or plank, invariably turned away from the obstruction irrespective of the incidence of light. When the growing points of neighbouring branches were turned directly towards each other, they mutually turned aside or one stopped growth. Some co-ordinating system was necessary to enable the parts to act in concert, and he attributes this to a continuity of the threads of protoplasm.—A paper was read on *Heterolepidotus grandis*, a fossil fish from the Lias, by James W. Davis. The author describes the specialities of this form, and remarks that the genus had been instituted by Sir Philip Egerton for certain forms closely related to Lepidotus, but differing in their dentition and scaly armature. The *H. grandis* has interest, among other things, in the attachment of the dorsal and anal fins with the series of well-developed interspinous bones, in the peculiar arrangement of the articular apparatus of the pectoral fins, and in the heterocercal form of the tail.

Chemical Society, December 18, 1884.—Dr. Russell, F.R.S., in the chair.—The following gentlemen were elected Fellows:—W. P. Ashe, Sir B. V. S. Brodie, Bart., J. F. Ballard, W. Briggs, M. T. Buchanan, W. G. Brown, H. M. Chapman, W. H. Eley, J. Frost, T. P. Hall, H. J. Hodges, H. Jackson, F. Johnson, J. D. Johnstone, G. F. Kendall, C. W. Low, F. M. Mercer, P. C. Porter, V. E. Perez, A. Rickard, K. B. B. Sorabji, R. B. Steele, H. Smith, E. G. Smith, G. Thorn, W. Tate, P. C. Thomas, T. Wilton, J. H. Worrall, W. C. Wise, W. H. Wood.—The following paper was read:—Chemico-physiological investigations on the cephalopod liver and its identity as a true pancreas, by A. B. Griffiths. The author could not detect any bile acids or glycogen in this organ, but a ferment obtained from it by glycerine converted starch paste into sugar, and formed from fibrin, obtained from the muscular fibres of a young mouse, leucin and tyrosin, the latter body giving, with a neutral solution of mercuric nitrate, a red precipitate. It was announced that at the next meeting, January 15, Prof. Thorpe would read a paper on the atomic weight of titanium, and that Dr. Frankland would give a lecture in February on chemical changes produced by micro-organisms.

Royal Microscopical Society, December 10, 1884.—Rev. Dr. Dallinger, F.R.S., President, in the chair.—Mr. Crisp exhibited Dr. Cox's radial microscope, a simplified form of Mr. Wenham's stand.—Mr. J. Mayall, jun., exhibited a new stage which he had devised, in which the thin upper plate was abolished and a frame to hold the slide substituted, which is not liable to flexure.—Mr. Crisp also exhibited Ward's eye-shade, Bausch's adapter for a spot lens, and Kain's mechanical finger.—Mr. Rosseter's paper on the gizzard of the larva of *Corethra plumicornis* and its uses, and one of Mr. G. F. Dowdeswell, on variations in the development of a Saccharomyces, were read and discussed.—A communication was read from Dr. Cox, the President of the American Society of Microscopists, expressing scepticism as to the possibility of making sections of diatoms so thin as those claimed by Dr. Flögel, as recently published in the Society's *Transactions*.—Mr. Parsons exhibited the hydroid form of *Limnocodium Sowerbii*, the fresh-water Medusa which he had found in April last at the Botanic Gardens, Regent's Park.—Dr. Zenger's method of mounting diatoms so as to show both sides was explained, and some mounts exhibited.—Mr. Cheshire gave a *résumé* of his paper on some new points in the anatomy of the bee. It has long been known that the queen bee, in common with many insects, stores the spermatozoa she receives from the male in a small sac, which is called the spermatheca. A long chain of evidence has also satisfied entomologists that in some way these spermatozoa are transferred to those eggs which are to be converted into undeveloped females known as workers, but the manner of this fertilisation has not hitherto been demonstrated. By carefully dissecting out a spermatheca with its attachment to the oviduct unbroken, and then by needle-knives cutting through the trachea which incloses it completely, the spermatheca and its valve may be isolated. It is then seen to be accompanied by a long double gland having a centrally-placed duct, provided with a sphincter muscle near its junction with the aperture of the spermatheca. The spermatheca itself carries a sphincter and three muscles, two to aid and